

REMARKS

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Claims 6, 7, 10, 12, 15-17, and 19 have been canceled.

New claim 20 has been added.

This amendment adds, changes and/or deletes claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending the claims as set forth above, claims 1-5, 8, 9, 11, 13, 14, 18, and 20 are now pending in this application.

Claim Objections

Claims 1, 7, 13, and 16 are objected to for containing informalities. The claims have been amended to overcome these objections. Withdrawal of the objections is respectfully requested.

Rejection under 35 U.S.C. § 102

Claims 1-5 are rejected under 35 U.S.C. § 102(b) as being unpatentable over U.S. Patent No. 6,392,248 (hereafter "Takahara et al."). This rejection is respectfully traversed.

Amended claim 1 recites a phosphor sheet for a radiation detector provided to be attached to a photoelectric conversion film of the radiation detector, comprising a support having a sheet shape; and a phosphor layer which emits light in response to rays of radiation transmitted through a specimen, and including a layer coated on said support with powder of a rare earth oxysulfide phosphor activated by europium of concentration in a range of 0.01 mol% to 3.5 mol%, wherein said phosphor layer has a surface that is configured to be layered on the photoelectric conversion film, wherein the photoelectric conversion film includes an

amorphous silicon film or a single crystal silicon film, wherein the surface has surface roughness of $0.5\ \mu\text{m}$ or less in average roughness Ra. Claims 2-4 depend from amended claim 1.

According to embodiments described in Applicant's disclosure, a phosphor sheet includes a phosphor layer with a surface that is configured to be layered on a photoelectric conversion film. In other words, the surface of the phosphor layer constitutes an interface of the phosphor layer and the photoelectric conversion film. Accordingly, the state of the surface of the phosphor layer that constitutes such an interface is important in regard to the photoelectric layer's conversion of light emitted by the phosphor layer into an electric charge. For example, if relatively large irregularities occur at the phosphor layer surface, light emitted from the phosphor layer can be scattered and the definition of a radiation image can be lowered. By providing a phosphor layer surface, which is configured to be layered on a photoelectric conversion film, with a surface roughness of $0.5\ \mu\text{m}$ or less in average roughness Ra, a phosphor sheet can be provided that advantageously scatters less light and provides enhanced definition for a radiation image, such as an X-ray image.

Takahara et al. discloses a color light emission sheet 4 that includes a flexible sheet base 6 and a phosphor layer 7 disposed on the sheet 6. See Takahara et al. at col. 7, line 63, to col. 8, line 2. Takahara et al. discloses that the color light emission sheet 4 can be made by mixing phosphor particles with a binder, adding a solvent to prepare a phosphor coating liquid, and coating the liquid onto the sheet base 6 and drying the liquid to form the phosphor layer 7. See Takahara et al. at col. 10, lines 33-41.

However, Takahara et al. does not disclose a phosphor sheet comprising a support and a phosphor layer, "wherein said phosphor layer has a surface that is configured to be layered on the photoelectric conversion film...wherein the surface has surface roughness of $0.5\ \mu\text{m}$ or less in average roughness Ra." Takahara et al. is silent in regard to the surface roughness of the color light emission sheet 4. Therefore, Takahara et al. does not disclose all of the features recited in amended claim 1. Withdrawal of this rejection is respectfully requested.

Rejection under 35 U.S.C. § 103

Claims 6-8, 10, 15-17, and 19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takahara et al., as applied to claim 1, and further in view of U.S. Patent No. 6,429,430 (hereafter “Sato et al.”), U.S. Patent No. 5,545,899 (hereafter “Tran et al.”), and U.S. Patent No. 6,384,417 (hereafter “Okumura et al.”). This rejection is respectfully traversed. Claims 6, 7, 10, 15-17, and 19 have been canceled. Claim 8 depends from amended claim 1.

As discussed above, Takahara et al. fails to disclose or suggest all of the features recited in amended claim 1.

Sato et al. discloses a scintillator panel 2 that includes a scintillator 12, a substrate 10, first transparent organic film 14, a transparent inorganic film 16, and a second transparent organic film 18. See Sato et al. at col. 3, lines 9-32. However, Sato et al. does not disclose or suggest a phosphor sheet comprising a support and a phosphor layer, “wherein said phosphor layer has a surface that is configured to be layered on the photoelectric conversion film...wherein the surface has surface roughness of 0.5 μm or less in average roughness Ra.”

Tran et al. discloses a radiation detection panel 10 that includes a flat substrate 14, individual photosensitive modules 12, a phosphor layer 16, and a protective front plate 18. See Tran et al. at col. 4, lines 58-67. However, Tran et al. does not disclose or suggest a phosphor sheet comprising a support and a phosphor layer, “wherein said phosphor layer has a surface that is configured to be layered on the photoelectric conversion film...wherein the surface has surface roughness of 0.5 μm or less in average roughness Ra.”

Okumura et al. discloses a ceramic scintillator that is produced by sintering particles and heat treating the sintered body. See Okumura et al. at col. 2, lines 59-65; col. 3, lines 2-6; col. 4, lines 50-53; col. 7, lines 2-18. Okumura et al. discloses that the mean surface roughness of the sintered body is greater than or equal to 0.01 μm and smaller than or equal to 0.8 μm . However, Okumura et al. discloses such a surface roughness for a sintered body of a phosphor layer, not a phosphor layer that has been produced by drying a liquid solution of phosphor particles on a support sheet. Furthermore, Okumura et al. does not disclose or

suggest a phosphor layer with a surface roughness of $0.5\ \mu\text{m}$ or less in average roughness Ra, wherein the phosphor layer is coated on a support having a sheet shape.

It would not have been obvious to one of ordinary skill in the art to have combined the teachings of Takahara et al., Sato et al., Tran et al., and Okumura et al. to provide the phosphor sheet recited in amended claim 1. A basic requirement of a *prima facie* case of obviousness is that a prior art reference, or prior art references, must teach or suggest all of the claim limitations. See M.P.E.P. §§ 2143, 2143.01. The Office has not set forth a *prima facie* case of obviousness because the combination of Takahara et al., Sato et al., Tran et al., and Okumura et al. do not disclose or suggest all of the features of amended claim 1. Takahara et al. discloses a color light emission sheet 4 that can be made by mixing phosphor particles with a binder, adding a solvent to prepare a phosphor coating liquid, and coating the liquid onto the sheet base 6 and drying the liquid to form the phosphor layer 7.

Although Okumura et al. discloses a phosphor layer that has a mean surface roughness greater than or equal to $0.01\ \mu\text{m}$ and smaller than or equal to $0.8\ \mu\text{m}$, the phosphor layer disclosed by Okumura et al. is formed by sintering and heat treating particles. This phosphor layer is different than the phosphor layer of Takahara et al. because the phosphor layer disclosed by Takahara et al. is made by a different process. The phosphor layer of Takahara et al. is formed onto a support from a liquid solution. Okumura et al. does not disclose or suggest the surface roughness of a phosphor layer formed from a liquid solution onto a support.

Because Okumura et al. does not disclose or suggest the surface roughness of a phosphor layer that is formed from a liquid solution, it would not have been obvious to one of ordinary skill in the art to combine the teachings of Takahara et al., Sato et al., Tran et al., and Okumura et al. to provide a phosphor layer coated on a support with a sheet shape, wherein a surface of the phosphor layer configured to be layered on a photoelectric conversion film has a surface roughness of $0.5\ \mu\text{m}$ or less in average roughness Ra.

Furthermore, Okumura et al. discloses a sintered body with a surface roughness greater than or equal to $0.01\ \mu\text{m}$ and smaller than or equal to $0.8\ \mu\text{m}$. Okumura et al. does not

disclose or suggest that the sintered body is formed on a support having a sheet shape, nor would one of ordinary skill in the art have a motivation to form such a sintered body on a support. Therefore, the phosphor layer produced by the combination of Takahara et al., Sato et al., Tran et al., and Okumura et al. would have a surface roughness greater than or equal to $0.01\ \mu\text{m}$ and smaller than or equal to $0.8\ \mu\text{m}$, but be a sintered body that is not formed on a support having a sheet shape, as recited in amended claim 1.

For at least the reasons discussed above, the Office has not set forth a *prima facie* case of obviousness. Furthermore, a *prima facie* case of obviousness cannot be made on the basis of Takahara et al., Sato et al., Tran et al., and Okumura et al. because these references do not disclose or suggest all of the features of amended claim 1. Withdrawal of this rejection is respectfully requested.

Claim 9 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Takahara et al., Sato et al., Tran et al., and Okumura et al., as applied to claim 7, and further in view of U.S. Patent No. 6,394,650 (hereafter “Ohara et al.”). This rejection is respectfully traversed. Ohara et al. fails to remedy the deficiencies of Takahara et al., Sato et al., Tran et al., and Okumura et al. discussed above in regard to independent claim 1, from which claim 9 depends. Withdrawal of this rejection is respectfully requested.

Claims 11-14 and 18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takahara et al. in view of Sato et al. and Tran et al. This rejection is respectfully traversed.

Amended claim 11 recites a radiation detector, comprising a phosphor sheet configured to convert radiation rays transmitted through a specimen into light, wherein the phosphor sheet comprises a support having a sheet shape, and a phosphor layer including a layer coated on said support with powder of a rare earth oxysulfide phosphor activated by europium of concentration in a range of 0.01 mol% to 3.5 mol%; a photoelectric conversion film on which said phosphor sheet is layered, and which converts the light from said phosphor sheet into electric charges, wherein the photoelectric conversion film comprises an amorphous silicon film or a single crystal silicon film; and a charge information reading section having a plurality of pixels in contact with said photoelectric conversion film and

reading out the electric charges generated on said photoelectric conversion film for each of the plurality of pixels as image signals of the radiation rays, wherein said phosphor layer has a surface that is layered on the photoelectric conversion film, wherein the surface has surface roughness of 0.5 μm or less in average roughness Ra.

~~Takahara et al., Sato et al., and Tran et al., alone or in combination, fail to disclose a phosphor layer, “wherein said phosphor layer has a surface that is layered on the photoelectric conversion film, wherein the surface has surface roughness of 0.5 μm or less in average roughness Ra.”~~ Takahara et al., Sato et al., and Tran et al. do not disclose or suggest the surface roughness of a phosphor layer. Nor do these references disclose or suggest that a surface of a phosphor layer that is layered on a photoelectric conversion film has a surface roughness of 0.5 μm or less in average roughness Ra.

Takahara et al., Sato et al., and Tran et al., alone or in combination, fail to disclose or suggest all of the features of amended claim 11. Therefore, it would not have been obvious for one of ordinary skill to combine the teachings of Takahara et al., Sato et al., and Tran et al. to provide the radiation detector of amended claim 11. Nor would one of ordinary skill in the art have had a motivation to make such a combination. Withdrawal of this rejection is respectfully requested.

Double Patenting

Claims 1-4, 11-14, and 18 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 2, 6, and 7 of copending Application No. 10/547,314 in view of Sato et al. and Tran et al. This rejection is respectfully traversed. Claim 1 has been amended to incorporate the features of claim 6. Claims 2-4 depend from claim 1. Claim 11 has been amended to incorporate similar features. Claims 13, 14, and 18 depend from claim 11. The combination of claims 2, 6, and 7 of Application No. 10/547,314, Sato et al., and Tran et al. fails to disclose or suggest a phosphor sheet with the surface roughness features recited in claims 1 and 11. Therefore, it would not have been obvious to modify claims 2, 6, and 7 of Application No. 10/547,314 by the teachings of Sato

et al. and Tran et al. to provide the phosphor sheet of claim 1 or the radiation detector of claim 11. Withdrawal of this rejection is respectfully requested.

New Claim

New claim 20 has been added. Claim 20 depends from claim 1. Applicant submits that claim 20 is allowable over the prior art for at least the reasons discussed above.

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

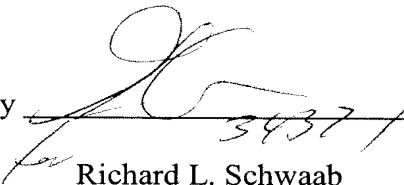
The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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